Letter to Editor

Pre-Heparin Serum Lipoprotein Lipase Concentrations in Obese Men of Contrasting Physical Activity Status: A Preliminary Study

Pre-heparin serum lipoprotein lipase (LPL) is catalytically inactive (i.e. not directly involved in the hydrolysis of triacylglycerol-rich lipoproteins in the blood¹⁾) and its physiological role is not fully understood. Previous studies have shown that pre-heparin serum LPL concentrations were considerably lower in type 2 diabetic²⁾ and hyperlipidaemic³⁾ patients than in healthy individuals. These findings indicate that serum pre-heparin LPL may be an emerging risk marker for metabolic syndrome¹⁾; however, it is not known whether pre-heparin serum LPL concentrations differ with physical activity status. Here we report our preliminary findings of comparing pre-heparin serum LPL concentrations in active and inactive obese individuals.

Fifty-five obese men (aged 52.3 ± 1.0 years, mean $\pm$ SEM) without any history of chronic diseases and without lipid and/or glucose-lowering medication, were analysed. The present study defined obesity as a body mass index of 25 kg/m^2 or above⁴⁾. Fasting (i.e. after an overnight fast of at least 10 hours) venous blood samples were taken from an antecubital vein at least three days after completion of moderate to vigorous physical activity (MVPA). Pre-heparin serum LPL concentration was measured by enzyme-linked immunosorbent assay using commercially available kits (LPL-ELISA Daiichi; Sekisui Medical Co. Ltd., Tokyo, Japan). For the determination of physical activity levels, participants were asked to wear an uniaxial accelerometer (Lifecoder-EX; Suzuken Co. Ltd., Nagoya, Japan) for 4 to 5 consecutive weeks. By measuring the magnitude and frequency of accelerations, the device determines the level of activity intensity (i.e. 11 levels: 0, 0.5, 1–9; 0 is the lowest activity; 9 is the highest activity) every 4 seconds. Data from participants who had worn the accelerometer for at least 10 hours (600 minutes) a day for at least 4 weekdays and 1 weekend day (i.e. in total) after calculation of wear time were considered valid⁵⁾. The main physical activity variable used in this study was the time spent in MVPA. MVPA was calculated on a daily basis, and then used to estimate weekly activity, by taking a weighted average of daily weekday and weekend activity (i.e. weekly MVPA = (average daily weekday MVPA $\times$ 5) + (average daily weekend MVPA $\times$ 2)). All minutes of recording with ≥ 4 activity level were classified as MVPA⁶⁾. Based

on accelerometer data, participants were divided into either the active obese group (i.e. participants who performed MVPA for 250 minutes per week or above since this amount of physical activity appears to enhance long-term weight-loss maintenance for overweight and obese individuals⁷⁾) or the inactive obese group (i.e. participants who performed MVPA of less than 250 minutes per week). Statistical significance was accepted at the 5% level.

The physical characteristics of the active obese and inactive obese groups are shown in **Table 1**. Fasting pre-heparin serum LPL concentrations in the active obese group compared with the inactive obese group are shown in **Fig. 1**. Fasting pre-heparin serum LPL concentrations were significantly higher ($p=0.009$) in the active obese group ($61.0 \pm 4.3 \text{ ng/mL}$) than in the inactive obese group ($48.1 \pm 2.2 \text{ ng/mL}$). Fasting pre-heparin serum LPL concentrations were positively correlated with physical activity levels ($r=0.281$, $p=0.019$), and this relationship was still observed after adjusting serum triacylglycerol concentrations. Fasting serum triacylglycerol concentrations were significantly lower ($p=0.018$) in the active obese group ($1.40 \pm 0.58 \text{ mmol/L}$) than in the inactive obese group ($1.59 \pm 0.91 \text{ mmol/L}$). Fasting pre-heparin serum LPL concentrations were negatively correlated with fasting serum triacylglycerol concentrations ($r=-0.318$, $p=0.009$).

The present study demonstrates that active obese men exhibit higher pre-heparin serum LPL concentrations than inactive obese men, although age and body mass index did not differ between these two groups. The present study also shows that fasting pre-heparin serum LPL concentrations are inversely correlated with fasting serum triacylglycerol concentrations in obese men with various activity levels. We speculated that the higher pre-heparin serum LPL concentrations observed in the active group than the inactive group may simply be the result of an increase in total LPL (i.e. overall LPL from all body tissues) activity throughout daily physical activity since endurance-trained athletes had higher resting skeletal muscle and adipose tissue LPL activities than the untrained control⁸⁾. Although we acknowledge that having higher LPL activity does not necessarily reflect higher LPL mass, it is postulated that there is an increase in pre-heparin serum LPL (i.e. reflecting a small fraction of overall LPL from all body

Key words; Physical activity status, Pre-heparin lipoprotein lipase, Lipid metabolism

Table 1. Physical characteristics

	Active obese group (<i>n</i> = 12)	Inactive obese group (<i>n</i> = 43)
Age (years)	50.6 ± 2.2	52.8 ± 1.2
Body mass (kg)	86.0 ± 4.7	86.3 ± 2.4
Height (cm)	167.9 ± 2.3	170.1 ± 0.9
Body mass index (kg/m ²)	30.4 ± 1.5	30.0 ± 0.7
Waist circumference (cm)	104.6 ± 3.1	102.4 ± 1.7
Triacylglycerol (mmol/L)	1.40 ± 0.58*	1.59 ± 0.91
Total cholesterol (mmol/L)	5.04 ± 0.17	5.41 ± 0.13
HDL cholesterol (mmol/L)	1.24 ± 0.08	1.18 ± 0.04
Glucose (mmol/L)	5.58 ± 0.21	5.49 ± 0.24

Values are the mean ± SEM. HDL, high density lipoprotein. *Significantly different from the inactive obese group, *p* = 0.018.

Fig. 1. Mean (± SEM) fasting pre-heparin serum lipoprotein lipase (LPL) concentrations in the active obese (*n* = 12) and inactive obese (*n* = 43) groups. *Significantly different from the inactive obese group, *p* = 0.009.

tissues) detached from the endothelial surface if there is an increase in total LPL. In addition, we recently reported that 12 weeks of supervised jogging training in overweight/obese middle-aged men increases pre-heparin serum LPL concentrations and decreases serum triacylglycerol concentrations⁹).

It is worth mentioning, however, that it is not known whether high pre-heparin serum LPL concentrations observed in the active obese group in the present study is clinically relevant since we have examined a risk marker rather than clinical end points. Further cross-sectional study with a larger sample size is required to elucidate the role of pre-heparin serum LPL in relation to other lipids and lipoproteins.

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